

A STUDY OF CREDIT LENDING AND PREDICTION OF BANKRUPTCY USING BACKPROPAGATION NEURAL NETWORKS.

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ABSTRACT

Bankruptcy prediction is very important for all the organization in the financial sector since it affects the economy and leads to rise in many social problems with added incremental costs. There are large number of techniques have been developed to predict the bankruptcy, which helps the decision makers such as investors and financial analysts. One of the bankruptcy prediction models is backpropagation neural network. The paper first surveys the existing literature for various techniques that have been developed to assess credit risks including the credit scoring models and quantitative models pioneered by Beaver and Altman which focuses on the borrower's inability to meet credit obligation. Thereafter, this paper using the tailored back-propagation neural network endeavors to predict the financial ratios expressing the position of a firm to regulate the bankruptcy and assess the credit risks. It first estimates the financial ratio for a firm from 2001-2008 to the train the BPNN and uses the estimates of the year 2009 and 2010 values in the validation process. Finally it dwells to draw predictions for the period 2011-2015 and emphasizes the growing role of BPNN application based prediction models for banking sector with a case study of Oriental Bank of Commerce. The model provides the suggestions to make viable policy decisions to suit the terms of credit.

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INTRODUCTION

The recent global economy crashes are lessons learnt from the absence of effective early warning systems. The need of an effective failure prediction model to act as an alarm for the corporate is the basic need of any economic system. The model has to be robust over time so that it can sustain the variations in the terms of credit being both the policy measures and the diluting norms of credit. The liquidity crisis that began in 2008 with the collapse of Bear Stearns and Lehman Bros. may be slowly receding, although economists and government officials are not in agreement as to the extent of the recovery or the real condition of business enterprises. It has been purported that banks have been reluctant to lend as related in statements by various observers; 1 actual experience is that lending was 15.2% higher in May 2010 than in the year 2000, a time of relative prosperity in the Western economies.² If there has been any positive outcome from this situation, it may be in providing a unique laboratory to test the efficacy of existing legislation, regulation and standards used to measure corporate performance to prevent future catastrophes. With regard to the last of these controls, we can examine the results from before and after 2008.

Bankruptcy prediction remains a concern for the various stakeholders in a firm, owners, managers, investors, creditors and business partners, as well as government institutions responsible for maintaining the stability of financial markets and general economic prosperity.

Analysis of the financial position of the firm is very useful for the banking and financial industry, such a task for credit risk assessment. The insight of both practitioners and researchers, originating with the papers of Beaver (1967)] and Altman (1968) was that firms with certain financial structures have a greater probability of default, and eventual bankruptcy, than other types of firms. Credit analysis is a key component of modern finance. It is used in both the capital markets, evaluating bond investments and the banking markets, evaluating credit applications. Experience with the recent crisis forced the bank authorities and the central banks on the global level to draw a number of lessons. The result being the new Basel Capital Accord which enlisted guidelines that all banks should develop systematic validated methods for assessing the risks associated with lending. As a result the new rules may increase the operational security of the banks in granting the credit. They are required to establish objective

criteria and techniques for modeling the assessment of risk cutting down dependence on subjective personal judgment. Basel II norms are adopted to prevent banks from unexpected losses, improved profitability, increase risk carrying capacity and undertake more obligations. In consistence with the Basel Accord, it is realistic to expect that additional analytical tools be designed to manage the credit risk more effectively in the periods to come. We can therefore hope that credit scoring models would serve as a platform for these changes. Even though statistical models were formulated about 30 years ago, credit lending does not have any bench marks still paucity of default information continues to prove a principal obstacle to researchers.

This study analyses the ratios makes use of tailored neural network model. The prediction of the financial ratios would convey the position of the firm to regulate the credit risk associated to bankruptcy. The paper studies the application of neural network in forecasting financial ratios. The financial ratios have been divided into pillars. The paper is an attempt to forecast the ratios so as to communicate the financial position of the firm by forecasting the financial ratios upto 2015. Thus the aspects of lending can be evaluated and reestablished. Within the framework of the present study, it was attempted to construct a ratio model, which enable early identification of pattern for bankruptcy. The ratios are divided into pillars to state the area of financial viability. Neural network has been used for the forecasting of financial ratios. The financial position of the banks when the go out to obtain credit can be computed. The forecasted position can also benefit in planning the repayment period and also assists to plan the terms of credit.

1. LITERATURE REVIEW

Credit risk is probability that a borrower will fail to make required payments of principle and interest over the life of the loan. Risk plays an important role in the lending arena. At loan inception, the lender estimates the expected credit risk that the borrower presents over the life of the loan. Absent provisions to control the increase in credit risk, the lender prices the expected outcome in the interest rate of the loan. Both lender and borrower suffer when the expected credit risk of borrower is high, the lender with increased risk over the life of the loan and the borrower with a high interest rate. These suggest that both the parties involved in credit lending benefit when provisions are included in contrast to control increase in credit risk. Bankruptcy is the condition in which a business cannot meet its debt obligations petitions a federal district

court for either. This paper examines an alternative approach using neural network to forecast financial ratios so as to relate to prediction of bankruptcy before it actually occurs.

Academic studies seeking to predict corporate bankruptcies have a long history. An early study was based on a univariate analysis approach (Beaver 1966). Multivariate analysis techniques used in subsequent studies include discriminant analysis (Altman 1968), logit and probit regressions (Ohlson 1980, Zmijewski 1984) and hazard analysis (Shumway 2001). The exact variables used in these studies vary and include both accounting-based and market-based variables, but all of these studies have proposed reduced form models which are able to predict corporate bankruptcies with a fair degree of accuracy. Shumway (2001) compares the forecasting accuracy of a hazard model using a set of five variables, comprising two accounting-based and three market-based variables, to Altman's (1968) and Zmijewski's (1984) specifications which used mainly accounting-based variables, and concludes that the hazard model with accounting and market-based variables is the most accurate. In an examination of secular changes in the ability of accounting variables to predict bankruptcy, Beaver et al. (2005) find a slight decline in the predictive ability of financial ratios based on accounting variables over the period 1962 to 2002, with a corresponding improvement in the incremental predictive ability of market-based variables. Structural models of default, based on Merton (1974) and commercialized by firms like Moody's KMV (Crosbie and Bohn 2001), have also been studied (e.g., Vassalou and Xing 2004; Hillegeist et al. 2004). Although Hillegeist et al. (2004) find that these structural models outperform purely accounting-based, reduced form models, Campbell et al. (2008) find that information from structural models does not add any additional explanatory power to reduced form models utilizing both accounting and market information. Bharath and Shumway (2008) show that the functional form suggested by the Merton model is useful for predicting defaults, though it does not serve as a sufficient statistic for the probability of default.

2. MODEL DESIGN AND METHODOLOGY

In this paper, a two-step methodology has been adopted. The part A provides the steps formulated for the prediction of financial ratio pillars, followed by part B which enlists the steps followed for the prediction of financial ratios using artificial neural networks.

Part A: Formulation of Ratio Pillars

The basic ratios are formulated from details mentioned in published statements like balance sheet, cash flow statements, yearly details of banks, profit and loss statements obtained from CMIE database, Reserve Bank of India. Data is also taken from the official websites of the banks, financial institutions and the internet. Prior studies have identified financial ratio for bankruptcy prediction and the usefulness of these financial ratios for bankruptcy prediction can be known from the literature survey. Consequently this research work uses financial data i.e. published time series data for the last 11 years from 2000 to 2009. This research tries to present a holistic view by incorporating all various ratios and then relating them to examine the explanatory capabilities of the financial ratios to suggest the position of the bank. Construction of the basic ratios into ratio pillars is a vital ingredient of the basic work done prior to deployment of neural network.

Part A: Eight ratio pillars have been constructed for the needful being

1. Investment Valuation Ratio Pillar.
2. Profitability Ratio Pillar.
3. Management Efficiency Ratio Pillar.
4. Profit & Loss Ratio Pillar.
5. Debt Coverage Ratio Pillar.
6. Cash Flow Indicator Ratio Pillar.
7. Leverage Ratio. Ratio Pillar.
8. Overall Performance Ratio Pillar.

Part B: Prediction of Financial Ratios using ANN Model

1. Catering to Neural Network inputs
2. Tolerance level Minimization
3. Data convergence using Neural Networks
4. Formulation of Absolute error
5. Prediction of ratios in each Ratios pillar
6. Data Validation

3. BPNN Model application for Oriental Bank of Commerce

Oriental Bank of Commerce (OBC) was established in 1943 in the city of Lahore, which is currently in Pakistan. After the Indo-Pak partition, the registered office was shifted to Amritsar. During the 1970s, the bank suffered a serious financial crisis, which forced the owners of the bank to close down business. However, the employees came forward to make it a co-operative institution and continued business operations. Since then, the bank has expanded its horizons in terms of its customer base as well as product range. In 1980, the bank was nationalized by the Government of India. Oriental Bank of Commerce has made its mark in priority sector banking services. It has specialized products and services for small and medium enterprises (SME) and the rural population. Low-interest rate loans and debt restructuring facilities are available for enterprise customers.

The basic input sheets for all the eight pillars are formulated for OBC. The process of ratio pillar formulation uses the book formulae for computation of the ratios in each pillar, which will further be used as input parameters for Artificial Neural Network. The details of the ratios and the values are enlisted in the Table 1.

Table1: Ratios used as Inputs for the Neural Network for OBC.

Ratio Pillar	Tolerance	Ratios	2000	2001	2002	2003	2004	2005	2006	2007	2008
Investment Valuation	0.1	Dividend Per Share	0.08	0.1	0.1 2	0.16	1.3 4	2.5 2	4.5	7.3	9.1
		Operating Profit Per Share (Rs)	0.1	1.2 3	2.5 9	10.7 32	18. 87	27. 01	38.4 1	51.0 9	73.7
		Net Operating Profit Per Share (Rs)	0.1	2.4 5	5.2 6	10.2 1	11. 57	84. 35	174. 49	383. 69	452. 1
		Free Reserves Per Share (Rs)	107. 452	11 3.8	12 0.1	126. 529	132 .88	139 .24	144. 05	159. 68	173. 69
		Earnings Per Share	0.61	4.1	4.5	6.84	21.	12.	5.64	11.6	13.1

			7	6	5	31	42	64	88	49	5
		<i>Book Value</i>	10.5	16.	23.	35.6	37.	46.	22.2	36.1	45.2
			4	6	7	3	71	84	4	4	9
Profit & Loss	0.1	<i>Interest Expended / Interest Earned</i>	45.3	48.	51.	54.8	57.	61.	61.0	67.2	75.4
			9	5	6	33	97	12	3	5	
		<i>Other Income / Total Income</i>	2.60	2.4	2.2	2.09	1.9	1.7	1.54	1.7	1.01
			2	3	6	2	22	52			
		<i>Operating Expense / Total Income</i>	18.3	18.	17.	17.4	17.	16.	20.1	15	11.0
			5	0	7	7	17	88	7		3
		<i>Selling Distribution Cost Composition</i>	0.38	0.3	0.3	0.3	0.2	0.2	0.2	0.22	0.14
			4	56	28		72	44			
		<i>Current Ratio</i>	0.08	0.0	0.0	0.06	0.0	0.0	0.05	0.03	0.02
			4	7	7	3	56	49			
		<i>Quick Ratio</i>	3.31	4.8	6.3	7.83	9.3	10.	15.0	13.8	12.1
			4	2	3	8	46	85	3	7	3
Profitability	0.1	<i>Interest Spread</i>	3.05	3.1	3.2	3.33	3.4	4.0	3.14	3.27	3.77
			1	4	3		23	9			
		<i>Adjusted Cash Margin (%)</i>	3.19	3.3	3.4	3.57	3.6	3.6	3.94	4.4	4.18
			2	1	4		96	7			
		<i>Net Profit Margin</i>	18.1	17.	17.	16.7	16.	15.	16.3	14.1	13.7
			7	7	2	66	29	64	5		2
		<i>Return on Long Term Fund (%)</i>	14.8	14.	14.	14.2	14.	13.	14.5	12.5	12.6
			4	6	4	54	05	84		3	8
		<i>Return on Net Worth (%)</i>	1.30	14.	28.	41.6	55.	81	74.5	80.7	111.
			9	7	2	92	15		7	6	5
		<i>Adjusted Return on Net</i>	16.7	17.	17.	17.9	18.	22.	17.0	16.0	19

		<i>Worth (%)</i>	7	1	5	9	39	49	1	3	
		<i>Gross Profit Ratio</i>	8.30	9.7	11.	12.5	14.	17.	15.8	15.1	18.9
			6	3	1	84	01	95	3	7	9
Leverage	0.1	<i>Financial Leverage</i>	9.26	7.2	7.9	4.63	3.8	2.6	3.45	3.60	4.29
			1	6	9	2	41	1	9	5	8
		<i>Net financial leverage</i>	18.2	16.	17.	14.4	13.	14.	9.87	11.5	13.7
			7	0	9	95	58	60	7	38	9
		<i>Operating Leverage</i>	0.16	0	0.2	1.09	0.0	0.2	0.30	0.41	0.88
			6		4	9	92	38	1	6	1
		<i>Interest Coverage</i>	1.05	1.1	1.1	1.27	1.3	1.6	1.40	1.38	1.30
			5	6	4	5	52	21	7	4	3
		<i>Long Term Debt / Equity</i>	0.96	1.1	3.2	3.97	3.6	3.7	3.49	2.48	7.34
	5	8	0	8	38	82	8	5	3		
<i>Debt-Equity ratio</i>	439.	49	59	661.	714	774	873.	938.	107		
	652	6.8	9.7	654	.18	.87	804	38	6.50		
		74	42		7	2			6		
<i>Owner's fund as % of Total Source</i>	14.7	12.	11.	9.12	7.1	5.7	4.84	4.47	4.33		
	8	4	8	8	93	87	5	4	8		
<i>Total debt to assets ratio</i>	0.92	0.9	0.9	0.9	0.8	0.8	0.86	0.87	0.87		
	8	2	0		87	98	7	4	9		
<i>Long term debt to assets ratio</i>	0.00	0.0	0.0	0.02	0.0	0.0	0.01	0.00	0.02		
	9	0	1	3	17	13	5	8			
Debt Coverage	0.1	<i>Credit Deposit Ratio</i>	50.8	52.	54.	57.0	59.	61.	60.0	68.0	69.5
			4	9	9	53	12	19	5	6	8
		<i>Investment Deposit Ratio</i>	43.7	42.	40.	39.2	37.	36.	35.8	32.0	30.8
	72	24	72	03	68	157	6	7	5		
		9	6								
<i>Cash Deposit Ratio</i>	15.4	14.	13.	12.8	12.	11.	10.9	8.41	8.92		
	4	5	7	89	03	18	3				

		<i>Total Debt to Owners Fund</i>	0.54 8	1.1 7	2.9 0	4.63	6.3 56	8.0 82	9.71 11.4	13.4 3	8
		<i>Financial Charges Coverage Ratio</i>	1.61 4	1.5 7	1.5 3	1.49 4	1.4 54	1.4 14	1.41	1.32	1.27
		<i>Financial Charges Coverage Ratio Post Tax</i>	1.42 4	1.3 9	1.3 6	1.34	1.3 12	1.2 84	1.25	1.26	1.18
<i>Cash-flow</i>	0.1	<i>Dividend Payout Ratio Net Profit</i>	14.2 04	15. 00	15. 80	16.6 07	17. 408	18. 209	23.0 7	16.4 8	16.3 8
		<i>Dividend Payout Ratio Cash Profit</i>	11.1 3	12. 0	13. 0	14.0 1	14. 97	15. 93	20.3 1	15.1 6	15.0 4
		<i>Earning Retention Ratio</i>	97.6	95. 4	93. 3	91.2 28	89. 10	86. 98	84	82.6	83.5 7
		<i>Cash Earning Retention Ratio</i>	98.3 2	96. 3	94. 2	92.2 6	90. 24	88. 22	85.3 7	84.0 6	84.9 2
		<i>Adjusted Cash Flow Times</i>	3.05 8	7.7 1	18. 4	29.2 55	40. 02	50. 79	57.1 3	74.8 7	85.2 4
<i>Managerial Efficiency</i>	0.1	<i>Interest Income / Total Funds</i>	5.19 6	5.6 2	6.0 5	6.48 9	6.9 2	7.3 51	7.74	7.97	8.88
		<i>Interest Expended / Total Funds</i>	2.13 6	2.5 8	3.0 3	3.48 3	3.9 32	4.3 81	4.45	5.23	6.26
		<i>Operating Expense / Total Funds</i>	0.99 6	1.0 4	1.0 9	1.14 6	1.1 96	1.2 46	1.59	1.22	0.99
		<i>Profit Before Provisions / Total Funds</i>	2.02 8	1.9 66	1.9 04	1.84 2	1.7 8	1.7 18	1.69	1.55	1.63
		<i>Net Profit / Total Funds</i>	0.92 4	0.9 1	0.8 9	0.88 5	0.8 72	0.8 59	0.99	0.87	0.43
		<i>Loans Turnover</i>	0.13	0.1	0.1	0.14	0.1	0.1	0.15	0.14	0.15

			4	3	3		42	44			
		<i>Total Income / Capital Employed (%)</i>	5.37	5.7	6.2	6.63	7.0	7.4	7.86	8.1	8.97
		<i>Interest Expended / Capital Employed (%)</i>	2.13	2.5	3.0	3.48	3.9	4.3	4.45	5.23	6.26
		<i>Asset Turnover Ratio</i>	6.43	6.3	6.2	6.15	6.0	5.9	5.15	5.87	7.54
			2	4	5	9	68	77			
Overall	0.1	<i>Capital Adequacy Ratio</i>	12.0	12.	12.	12.2	12.	12.	12.4	12.5	12.1
			1	0	1	07	27	33	6	1	2
		<i>Advances / Loans Funds (%)</i>	62.4	63.	65.	66.8	68.	69.	67.3	76.3	75.6
			9	9	3	37	28	73	9		2
		<i>Return on invested capital (ROIC)</i>	0.10	0.0	0.0	0.08	0.0	0.0	0.08	0.06	0.04
			7	9	8	4	85	81	6	4	3
		<i>Return on Equity (ROE)</i>	0.14	0.1	0.0	0.12	0.1	0.1	0.13	0.13	0.12
	6	7	9		37	34	6	9	8		
		<i>Fixed Assets Ratio</i>	1.31	1.5	1.8	2.06	2.4	3.6	3.38	3.59	3.87
			9	9	5	2		42	6	9	2
		<i>Capital Turnover Ratio</i>	1.51	1.3	1.2	1.05	0.9	0.8	0.59	0.66	0.67
			3	8	3	7	76	14	1	2	8
		<i>Sales /net fixed Assets</i>	18.4	19.	19.	21.1	20.	10.	9.37	10.9	13.4
			8	0	5	42	58	68	9	84	9

4. BPNN Modeling analysis, results and outcomes

After the computation of the basic ratio pillars, as suggested by Table 1, this section uses the ratios in each pillar as inputs to train the network. The network after training computes the values of the ratios from 2009 upto the year 2015 at different tolerance level. The validation is done by the values obtained for the year 2009 and 2010. The tolerance level that provides the closest values is considered for prediction. The Table 2 provides details of the convergence study done for all the pillars for the banking the study. Table 3 provides details of the percentage error at the adopted level of tolerance.

Table 2: The convergence detail for OBC.

Ratio Pillar	Size	Tolerance Level	Epochs
Investment Valuation Ratio	1-8-7	0.1	31124560
Profit & Loss Ratio	1-7-6	0.2	3129190
Profitability Ratio	1-8-7	0.1	2798377
Leverage Ratio	1-10-9	0.2	2581875
Debt Coverage Ratio	1-7-6	0.2	4581875
Cash Flow Ratio	1-6-5	0.2	1581875
Managerial Efficiency Ratio	1-10-9	0.1	22345673
Overall Ratio	1-8-7	0.4	2143960

Table 3: The percentage error and Tolerance Level for the Ratio Pillars

Ratio Pillar	Tolerance	Ratios	2000	2001	2002	2003	2004	2005	2006	2007	2008
<i>Investment Valuation</i>	0.1	<i>Dividend Per Share</i>	1	1	1	1	2	3	6	10	10
		<i>Operating Profit Per Share (Rs)</i>	2.5 64	3.6 54	4.87 6	5.57 6	27. 289	69. 32	57 3	74. 53	109. 8
		<i>Net Operating Profit Per Share (Rs)</i>	30. 23	39. 62	45.5 6	53.2 32	150 .04	308 .04	31 0.5	38 3.8	505. 09
		<i>Free Reserves Per Share (Rs)</i>	68. 828	68. 296	67.7 64	67.2 32	66. 7	63. 79	69. 61	64. 29	63.7 9
		<i>Earnings Per Share</i>	17. 061 35	19. 484 55	20.2 34	15.2 91	17. 65	18. 144	22. 67 5	31. 80 8	44.8 54

		<i>Book Value</i>	10. 408 33	18. 053 33	26.5	31.7 4	41. 79	44. 72	45. 65	48. 84	64.9 8	
		<i>Net Operating Income per share</i>	88. 85	109 .45	135. 6	139. 59	176 .81	248 .93	28 7.7 9	32 1.6 5	341. 98	
Profit & Loss	0.1	<i>Interest Expended / Interest Earned</i>	33. 899	37. 084	40.2 69	43.4 54	46. 639	52. 64	51. 31	52. 2	61.2	
		<i>Other Income / Total Income</i>	5.2 26	4.8 04	4.38 2	3.96	3.5 38	4.6 2	1.3 3	1.5 2	1.43	
		<i>Operating Expense / Total Income</i>	44. 89	42. 36	39.8 4	37.3 24	34. 80	30. 19	31	30. 3	23.1	
		<i>Selling Distribution Cost Composition</i>	0.2 74	0.2 58	0.24 2	0.22 6	0.2 1	0.1 9	0.2	0.2 4	0.1 4	0.14
		<i>Current Ratio</i>	0.0 47	0.0 44	0.04 1	0.03 8	0.0 35	0.0 3	0.0 3	0.0 3	0.0 3	0.02
		<i>Quick Ratio</i>	5.0 09	5.6 34	6.25 9	6.88 4	7.5 09	5.9 8	10. 6	11. 1	9.4	
Profitability	0.1	<i>Interest Spread</i>	3.1 92	3.3 18	3.44 4	3.57	3.6 96	3.6 7	3.9 4	4.4	4.18	
		<i>Adjusted Cash Margin (%)</i>	18. 17	17. 70	17.2 3	16.7 66	16. 29	15. 64	16. 3	14. 1	13.7 2	
		<i>Net Profit Margin</i>	14. 84	14. 65	14.4 5	14.2 54	14. 05	13. 84	14. 5	12. 5	12.6 8	
		<i>Return on Long Term Fund (%)</i>	1.3 09	14. 77	28.2 3	41.6 92	55. 15	81	74. 5	80. 7	111. 5	
		<i>Return on Net Worth (%)</i>	16. 77	17. 18	17.5 8	17.9 9	18. 39	22. 49	17. 0	16. 0	19	
		<i>Adjusted Return on Net</i>	8.3	9.7	11.1	12.5	14.	17.	15.	15.	18.9	

		<i>Worth (%)</i>	06	32	5	84	01	95	8	1	9
		<i>Gross Profit Ratio</i>	0.7	0.7	0.74	0.76	0.7	0.7	0.7	10.	10.6
			5	69	1	2	52	25	1	7	0
Leverage	0.1	<i>Financial Leverage</i>	7.6	6.7	4.68	3.34	3.3	3.4	3.7	3.6	3.57
			58	23	5	8	37	17	7	4	9
		<i>Net financial leverage</i>	107	109	97.2	82.4	70.	49.	45.	46.	54.6
			.49	.17	47	72	788	209	26	85	37
			1							9	
		<i>Operating Leverage</i>	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00
			001	001	013	013	001	001	00	00	005
			7	5			2		09	07	
		<i>Interest Coverage</i>	1.1	1.1	1.27	1.42	1.4	1.4	1.3	1.3	1.38
			5	75	1	6	28	14	6	7	8
		<i>Long Term Debt / Equity</i>	971	119	131	1151	125	122	13	15	186
			.06	4.6	8.71	.251	1.6	4.9	02.	07.	8.47
			6	4	5		02	66	52	21	9
		<i>Debt-Equity ratio</i>	255	299	343.	324.	385	400	46	51	631.
			.0	.	5	99	.7	.3	0.	5.	2
		<i>Owner's fund as % of Total Source</i>	0.8	0.8	0.85	0.91	0.9	0.9	0.9	0.9	0.87
			44	7	1	8	36	62	6	7	5
		<i>Total debt to assets ratio</i>	0.8	0.8	0.88	0.88	0.8	0.8	0.8	0.8	0.86
			89	94	5	7	72	39	7	7	4
		<i>Long term debt to assets ratio</i>	0.8	0.8	0.88	0.88	0.8	0.8	0.8	0.8	0.86
			89	94	5	7	72	39	7	7	4
Debt Coverage		<i>Credit Deposit Ratio</i>	35.	39.	43.7	48.0	52.	56.	60.	65.	70.5
			13	43	4	46	35	33	6	9	5
		<i>Investment Deposit Ratio</i>	67.	63.	59.0	54.7	50.	48.	41.	33.	32.3
			75	40	5	06	35	56	1	2	8
		<i>Cash Deposit Ratio</i>	14.	14.	13.6	13.1	12.	8.4	14.	13.	9.02

			77	22	7	22	57	8	7	7	
		<i>Total Debt to Owners Fund</i>	8.7	9.5	10.3	11.1	11.	13.	13.	13.	15.4
			81	7	5	48	93	14	1	7	4
	0.1	<i>Financial Charges Coverage Ratio</i>	1.6	1.6	1.60	1.57	1.5	1.6	1.3	1.4	1.42
			69	38	7	6	45		9	2	
		<i>Financial Charges Coverage Ratio Post Tax</i>	1.4	1.4	1.43	1.40	1.3	1.3	1.3	1.2	1.25
			82	56		4	78	6	3	9	
<i>Cash-flow</i>	0.1	<i>Dividend Payout Ratio Net Profit</i>	1.7	4.5	7.33	10.1	12.	14.	14.	30.	23.4
			08	2	2	44	95	01	9	7	
		<i>Dividend Payout Ratio Cash Profit</i>	0.5	2.3	5.15	8.00	10.	12.	13.	27.	21.6
			43	06	5	4	85	4	2	2	1
		<i>Earning Retention Ratio</i>	98.	95.	92.6	89.8	87.	85.	84.	69.	76.5
			27	46	5	4	02	98	9	2	9
		<i>Cash Earning Retention Ratio</i>	100	97.	94.8	91.9	89.	87.	86.	72.	78.3
			.55	7	48	96	144	6	72	73	8
			2								
		<i>Adjusted Cash Flow Times</i>	71.	71.	71.7	71.7	71.	64.	73.	80.	75.0
			85	82	9	58	72	77	7	6	5
<i>Managerial Efficiency</i>	0.1	<i>Interest Income / Total Funds</i>	5.4	5.8	6.29	6.72	7.1	8.5	7.2	7.8	8.86
			17	54	1	8	65	2	3	8	
		<i>Interest Expended / Total Funds</i>	1.2	1.6	2.11	2.57	3.0	3.9	3.6	3.9	4.86
			17	68	9		21	1	3	2	
		<i>Operating Expense / Total Funds</i>	3.1	3.0	2.94	2.82	2.7	2.7	2.2	2.4	2.08
			93	7	7	4	01		7	3	
		<i>Profit Before Provisions / Total Funds</i>	1.1	1.2	1.36	1.46	1.5	2.1	1.2	1.5	1.96
			75	72	9	6	63	7	9	3	
		<i>Net Profit / Total Funds</i>	0.8	0.9	0.96	1.00	1.0	1.2	1.0	1	1.14
			88	28	8	8	48	4	6		
		<i>Loans Turnover</i>	0.1	0.1	0.17	0.17	0.1	0.1	0.1	0.1	0.15
			84	8	6	2	68	8	5	4	

		<i>Total Income / Capital Employed (%)</i>	5.8 38	6.2 44	6.65 9	7.05 6	7.4 62	8.9 4	7.3 3	8 8	8.99 8	
		<i>Interest Expended / Capital Employed (%)</i>	1.2 17	1.6 68	2.11 9	2.57 21	3.0 1	3.9 3	3.6 2	3.9 8	4.86 8	
		<i>Asset Turnover Ratio</i>	4.8 76	4.9 08	4.94 2	4.97 04	5.0 8	5.2 5	4.7 8	5.4 8	4.35 8	
Overall	0.1	<i>Capital Adequacy Ratio</i>	9.1 22	9.6 15	10.1 0	10.6 01	11. 09	11. 58	11. 8	12. 3	13.4 7	
		<i>Advances / Loans Funds (%)</i>	59. 09	61. 02	62.9 5	64.8 88	66. 81	68. 74	65. 6	76. 1	78.3 1	
		<i>Return on invested capital (ROIC)</i>	0.0 62	0.0 59	0.05 1	0.04 9	0.0 65	0.0 57	0.0 5	0.0 4	0.0 1	0.03 1
		<i>Return on Equity (ROE)</i>	0.2 08	0.2 42	0.24 2	0.29 3	0.2 99	0.3 01	0.1 8	0.1 7	0.20 2	
		<i>Fixed Assets Ratio</i>	1.3 66	1.5 93	1.85 1	2.06 2	2.4 42	3.6 8	3.3 9	3.5 9	3.87 2	
		<i>Capital Turnover Ratio</i>	3.2 98	3.0 58	2.86 2	2.60 1	2.1 04	1.8 2	1.2 7	1.2 7	1.40 7	
		<i>Sales /net fixed Assets</i>	7.9 7	8.6 16	9.18 3	9.86 9	8.7 93	9.4 01	9.9 2	11. 1	14.1 2	

OBSERVATIONS:

The ANN has been trained for prediction of ratios in each ratio pillar. This section provides a discussion of findings over the predicted ratios .It suggests the ratios that would viably be predicted in this model terming them as included ratios. It also provides the details of the ratios that cannot be predicted and would be excluded from the study. The section provides details of the predicted ratios of each pillar for all the pillars for the banks in the study. Certain suggestions and recommendations are also provided based on the analysis. The ratio pillars have further been described in detail:

The validation was carried out for all the ratios. By the analysis of standard error the included ratios and excluded ratios were formulated. The ratios that have shown a deviation greater than 25% from the actual field data estimates are ignored. Such ratios are termed as excluded ratios. The excluded ratios have not been considered in the prediction process and have been dropped out from the prediction process. The ratios are enlisted in *Table 4*. The estimates from 2001 to 2008 were applied to train the backpropagation neural network and subsequently estimate the values for the year 2009 to 2010 the data values were used for validation. Based on these values predictions were drawn using BPNN from 2011 to 2015. The market has witnessed several ups and downs during the period 2005 and 2010 and the modeled BPNN has been able to closely predict the values from 2005 to 2010. The trained BPNN has been able to forecast the values of the internal included ratios of the ratio pillar in approximation to the actual values suggesting that the BPNN has the ability to forecast the financial ratios.

Table 4: Included and Excluded ratios for OBC

Ratio Pillars	SE	Total	Included Ratios	Excluded Ratios
Investment Valuation	0.2	7	5- Operating Profit Per Share (Rs), Net Operating Profit Per Share (Rs), Free Reserves Per Share (Rs), Earnings Per Share, Net Operating Income per share	2- Dividend Per Share, Book Value
Profitability	0.1	7	5: Interest Spread, Return on Long Term Fund(%), Return on Net Worth(%), Adjusted Return on Net Worth(%), Gross profit Ratio	2: Adjusted Cash Margin(%), Net Profit Margin
Profit & Loss	0.2	6	6- Interest Expended / Interest Earned, Other Income / Total Income, Operating Expense /	Nil

			Total Income, Selling Distribution Cost Composition, Current Ratio, Quick Ratio	
Leverage	0.2	9	4:Financial Leverage, Interest Coverage, Debt-Equity ratio, Total debt to assets ratio	5:Net financial leverage, Operating Leverage, , Long Term Debt / Equity, Owner's fund as % of Total Source, Long term debt to assets ratio
Debt Coverage	0.2	6	5-Credit Deposit Ratio, Cash Deposit Ratio, Total Debt to Owners Fund, Financial Charges Coverage Ratio, Financial Charges Coverage Ratio Post Tax	1- Investment Deposit Ratio
Cash Flow	0.2	5	5:Dividend Payout Ratio Net Profit, Dividend Payout Ratio Cash Profit, Earning Retention Ratio, Cash Earning Retention Ratio, Adjusted Cash Flow Times	Nil
Managerial Efficiency	0.1	9	7.Interest Income / Total Funds, Interest Expended / Total Funds, Profit Before Provisions / Total Funds, Loans Turnover, Total Income / Capital Employed(%), Interest Expended / Capital Employed(%), Asset Turnover Ratio	operating Expense / Total Funds, Net Profit / Total Funds
Overall	0.4	7	5: Capital Adequacy Ratio, Advances / Loans	2: Return on invested Equity, Sales /net fixed Assets

			Funds(%),Return on invested capital (ROIC),Fixed Assets Ratio, Capital Turnover Ratio	
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5. ANALYSIS & FINDINGS

As per the above convergence study the table 5 provided the details of the size of ANN used for prediction and the associated level of tolerance.

Table 5: Details in brief of the predicted ratios in all eight pillars:

Ratio Pillar	Tolerance	Ratios	2009	2010	2011	2012	2013	2014	2015	
Investment Valuation	0.1	Operating Profit Per Share (Rs)	43.43307	52.28253	55.89827	69.28582	68.58913	70.47009	71.53062	
		Net Operating Profit Per Share (Rs)	230.0053	282.1139	326.4647	362.153	388.1296	405.6417	417.0793	
		Free Reserves Per Share (Rs)	153.0652	158.7116	163.2382	166.5244	168.7122	170.0982	170.9685	
		Earnings Per Share	13.15478	9.15478	13.15478	13.15478	13.15479	13.15479	13.15479	13.15479
		Net Operating Income per share	219.2618	232.8242	245.2317	255.4985	263.2914	268.855	272.7164	
		Interest Expended / Interest Earned	72.55538	72.81324	72.98978	73.07703	73.1085	73.11766	73.12018	
		Profit & Loss	0.2	Interest Expended / Interest Earned	75.45999	69.37322	70.08476	70.64138	71.0797	71.42758
Other Income / Total Income	1.095555			0.968583	0.864445	0.780104	0.712091	0.657185	0.61266	
Operating Expense / Total Income	14.19604			17.76386	17.37469	17.02931	11.72574	11.46048	11.22938	
Selling Distribution Cost	0.1366			0.1179	0.1030	0.0913	0.0820	0.0747	0.0688	

		Composition	93	68	68	18	58	29	85
		Current Ratio	0.0211	0.0172	0.0143	0.0121	0.0105	0.0093	0.0083
			34	45	47	9	72	44	98
		Quick Ratio	13.817	16.616	17.257	17.769	18.179	18.509	18.775
			07	12	49	99	93	28	59
Profitability	0.1	Interest Spread	4.3685	4.3649	3.8292	4.0881	3.9237	3.9584	3.9868
			82	73	62	41	95	01	22
		Return on Long Term Fund (%)	126.14	132.48	137.15	128.57	123.09	124.97	126.39
			96	94	4	29	33	23	31
		Return on Net Worth (%)	24.662	20.086	20.428	20.705	20.928	21.110	21.259
			26	39	85	17	74	53	3
		Adjusted Return on Net Worth (%)	22.200	22.183	22.168	21.156	20.147	22.139	22.133
			21	08	61	7	1	55	76
		Gross profit Ratio	13.480	13.948	13.993	13.499	13.504	13.509	13.514
			4	69	09		61	93	96
Leverage	0.2	Financial Leverage	5.8043	5.8102	4.8352	3.8711	3.9124	3.9556	3.9984
			4	5	3	1	4	5	2
		Interest Coverage	1.3059	1.2059	1.306	1.2860	1.3560	1.2260	1.2606
			3	7		2	4	5	5
		Debt-Equity ratio	1101.7	1443.7	1479.7	1510.3	1536.1	1557.8	1475.9
			5	92	99	76	72	31	65
		Total debt to assets ratio	0.9069	0.9065	0.9062	0.9060	0.9058	0.9057	0.9056
				6	8	6	8	3	1
Debt Coverage	0.2	Credit Deposit Ratio	71.565	72.667	75.357	76.65	76.943	82.236	84.529
		Cash Deposit Ratio	9.057	7.424	7.288	7.418	7.028	6.697	6.414
		Total Debt to Owners Fund	14.216	15.736	16.909	18.157	19.41	20.663	21.915
		Financial Charges Coverage Ratio	1.253	1.28	1.256	1.235	1.216	1.199	1.184
		Financial Charges Coverage Ratio Post Tax	1.168	1.214	1.203	1.192	1.183	1.174	1.167

Cash-flow	0.2	Dividend Payout Ratio Net Profit	23.695 02	22.946 72	19.172 02	19.372 4	19.549 75	19.706 16	19.843 77
		Dividend Payout Ratio Cash Profit	22.115 09	22.465 96	17.773 86	20.042 25	18.275 1	18.476 49	18.650 39
		Earning Retention Ratio	80.391 24	80.099 66	81.827 4	86.576 98	86.349 96	84.147 02	85.968 04
		Cash Earning Retention Ratio	80.828 68	81.591 04	85.370 33	88.168 51	84.986 74	87.825 43	87.684 38
		Adjusted Cash Flow Times	98.215 82	99.661 51	100.00 8	101.49 77	102.34 5	93.720 28	94.752 01
Managerial Efficiency	0.1	Interest Income / Total Funds	9.7056 8	8.8438 5	8.9320 4	8.9873 3	9.0221 3	9.0444 3	9.0591 1
		Interest Expended / Total Funds	6.6406 6	6.2300 7	6.4888 3	6.5734 5	6.6261 6	6.6595 8	6.6813 4
		Profit Before Provisions / Total Funds	1.3103 7	1.4821 7	1.1546 9	1.0369 5	0.9344 9	0.8489 6	0.7793 4
		Loans Turnover	0.1583 8	0.1516 9	0.1527 5	0.1535 8	0.1542 1	0.1547	0.1550 7
		Total Income / Capital Employed (%)	9.9447 8	9.1260 4	9.2488 2	9.3299 9	9.3834 3	9.4189 8	9.4430 9
		Interest Expended / Capital Employed (%)	6.6427 8	6.1551 3	6.4907 9	6.5751 7	6.6276 6	6.6609	6.6825 2
		Asset Turnover Ratio	4.4073 9	5.4824 4	5.9546 8	6.5971 7	6.6332	6.6565 4	6.6696 6
Overall	0.4	Capital Adequacy Ratio	13.429 92	12.452 95	12.472 15	12.487 78	12.500 31	12.510 32	12.518 32
		Advances / Loans Funds (%)	73.960 79	74.458 81	74.817 06	75.070 47	75.249 51	75.377 29	75.470 12
		Return on invested capital (ROIC)	0.0370 4	0.0273 1	0.0204 3	0.0158 2	0.0127 7	0.0107 2	0.0093 1

	Fixed Assets Ratio	4.0456	4.1342	4.1914	4.2280	4.2519	4.2678	4.2787
		4	6		7	4	5	8
	Capital Turnover Ratio	0.8629	0.6570	0.6848	0.7087	0.7277	0.7423	0.7533
		7	7	7	9	9	5	7

For *investment ratio pillar* it has been observed that the ratio Operating Profit Per Share (Rs) shows a movement of 4% to 32% as suggested by the network also being 1% to 23% (Graph 1). The ratio Net Operating Profit Per Share (Rs) shows a movement of 17% to 28% as suggested by the network also being 1% to 22%. The ratio Free Reserves Per Share (Rs) shows a movement of 0.5% to 9% a similar trend is projected by the network (Graph 2). For Earnings per Share shows a movement from 9% to 40% is observed and the network shows a similar fashion being approximately 3% to 43 %. For net operating income per share shows a movement from 3% to 11% is observed and the network shows a similar fashion being approximately 1% to 7 %.

In the *Profitability ratio pillar* it has been observed that the Interest Spread shows a range of 0.7 % 11to %, similar kind of error in the range of 0.8% to 3% is predicted by the network (Graph 3). The return on long term funds (%) moves in the range from 8% to 32% and the similar swing of 1% to 20% has been predicted by the neural network. (Graph 4).The ratio Return on Net Worth (%) shows a movement of 2% to 22% as suggested by the network also being 0.7% to 28 % (Graph5). The ratio Adjusted Return on Net Worth (%), shows a movement of 4% to 14% a similar trend of 0.6% to 15% is projected by the network. The ratio Gross Profit Ratio shows a movement of 1% to 28% a similar trend of 0.3% to 22% is projected by the network.

In the *Profit and Loss Ratio* it has been observed that the Interest Expended / Interest Earned moves in the range from 2% to 12% and the similar swing of 0.3% to 11% has been predicted by the neural network (Graph 6). The ratio Other Income / Total Income shows a movement of 6% to 23% as suggested by the network also being 2% to 17%.The ratio Operating Expense / Total Income shows a movement from 1% to 37% is observed and the network shows a similar fashion being approximately 2% to 31%. For Selling Distribution Cost Composition for Current Ratio a movement from 1% to 18% is observed and the network shows a similar fashion being approximately 2% to 14 % (Graph 7). For Current Ratio shows a movement from 0% to 33% is observed and the network shows a similar fashion being approximately 10% to 20%. For Quick

Ratio shows a movement from 4% to 82% is observed and the network shows a similar fashion being approximately 1% to 78%.

In the *leverage ratio pillar* uses the backpropagation Neural Network reveals that the Financial Leverage moves in the range from 4% to 42% and the same movement of ratios has been predicted by the neural network being 1% to 51 % (Graph 8). For the Interest Coverage the ratios oscillate in the range from 1% to 11% and the network suggests a similar trend of 1% to 10% (Graph 9). For debt to equity ratio shows a movement from 7% to 32% is observed and the network moved a similar pattern. For the Total debt to assets ratio shows a movement from 0.1% to 4% is observed and the network moved a similar pattern.

In the *Debt Leverage Ratio pillar* uses the backpropagation Neural Network suggests that the Credit Deposit Ratio shows a movement of 1% to 8% as suggested by the network also being 0.3% to 6.5% (Graph 10). For Cash Deposit Ratio shows a movement from 2% to 23% is observed and the network shows a similar fashion being approximately 1% to 18% (Graph 11). For Total Debt to Owners Fund shows a movement from 7% to 20% is observed and the network shows a similar fashion being approximately 6% to 18%. For Financial Charges Coverage Ratio shows a movement from 0.2% to 5.5% is observed and the network shows a similar fashion being approximately 1.2% to 4.4%. For Financial Charges Coverage Ratio Post Tax shows a movement from 0.8% to 3.3% is observed and the network shows a similar fashion being approximately 0.6% to 4.2%.

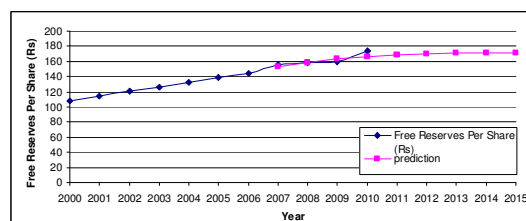
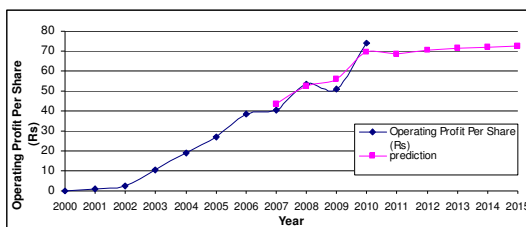
In the *Cashflow ratio pillar* it has been observed that the Dividend Payout Ratio Net Profit show a range of 5% to 15% a similar kind of error in the range of 4% to 16% is predicted by the network. The Dividend Payout Ratio cash Profit moves in the range from 5% to 20% and the similar swing of 5% to 17% has been predicted by the neural network. The ratio Earning Retention Ratio shows a movement of 1% to 8% as suggested by the network also being 1% to 7% (Graph 12). The ratio cash Earning Retention Ratio shows a movement of 2% to 8% a similar trend of 1% to 9% is projected by the network (Graph 13). For Adjusted Cash Flow Times shows a movement from 1.4% to 12% is observed and the network shows a similar fashion being approximately 1% to 8%.

In the *Managerial Efficiency ratio pillar* it has been observed that the Interest Income / Total Funds show a range of 2% to 11%, similar kind of error in the range of 0.3% to 14% is predicted by the network (Graph 14). The Interest Expended / Total Funds moves in the range from 1% to

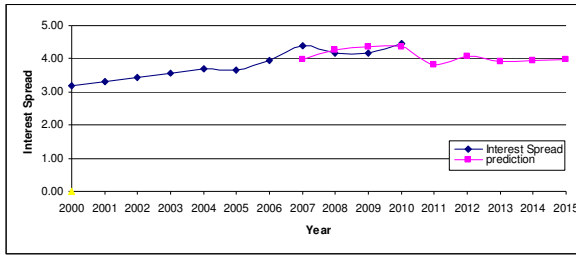
17% and the similar swing of 0.8% to 13% has been predicted by the neural network (Graph 15). The ratio Profit before Provisions / Total Funds shows a movement of 1.6% to 22% as suggested by the network also being 6% to 22%. The Loans turnover ratio being shows a movement from 1.2% to 6.6% a similar trend of 0.2% to 6.4% is projected by the network. The ratio being Total Income / Capital Employed (%) shows a movement from 3% to 10% is observed and the network shows a similar fashion being approximately 0.2% to 14%. The Interest Expended / Capital Employed (%), shows a movement from 8% to 21% is observed and the network shows a similar fashion being approximately 0.5% to 12%. The Asset Turnover Ratio shows a movement from 1.4% to 38% is observed and the network shows a similar fashion being approximately 0.3% to 39.85%.

In the *Overall ratio pillar* uses the backpropagation in the study it has been observed that the Capital Adequacy Ratio moves in the range from 0.5% to 7% and the similar swing of 0.1% to 7.5% has been predicted by the neural network (Graph 16). The ratio Advances / Loans Funds (%) shows a movement of 0.8% to 2% as suggested by the network also being 0.1% to 2%.(Graph 17). The ratio Return on invested capital (ROIC) shows a movement of 2% to 25% as suggested by the network also being 5% to 25% (Graph 18). The ratio Fixed Assets Ratio shows a movement of 2% to 7% a similar trend is projected by the network. For Capital Turnover Ratio shows a movement from 2% to 40% is observed and the network shows a similar fashion being approximately 1.5% to 40%.

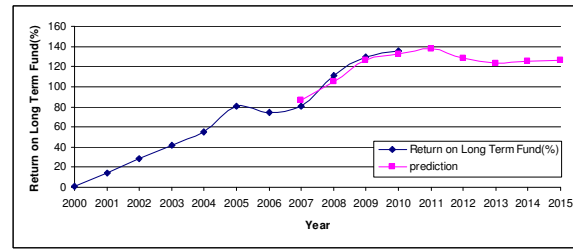
Certain graphs for the outcomes are shown below:



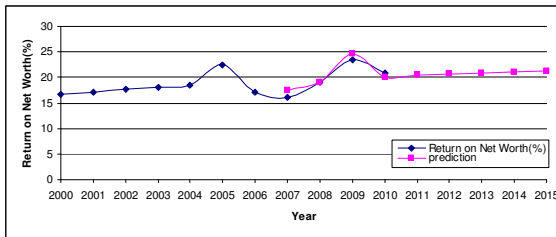
Graph 1: Operating Profit Per Share (Rs)



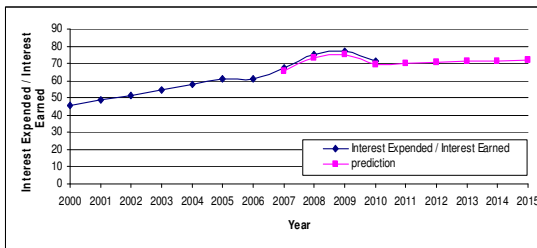
Graph 2: Free Reserves Per Share



Graph 3: Interest Spread

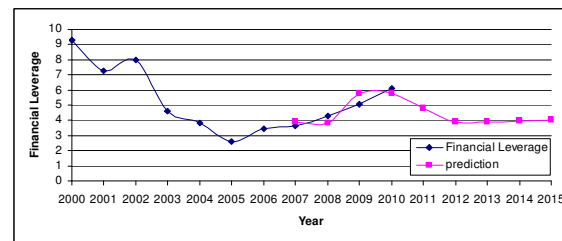
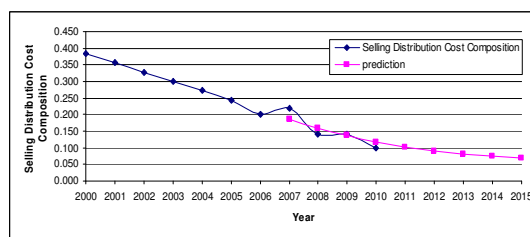


Graph 4: Return on Long Term Fund(%)



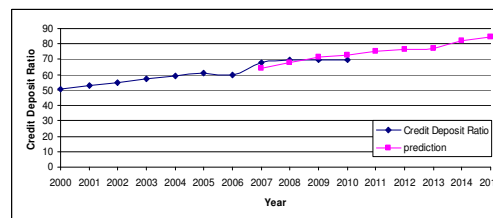
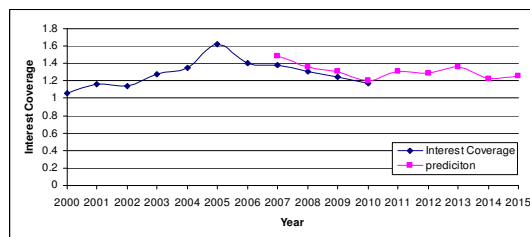
Graph 5: Return on Net Worth(%)

Graph 6: Interest Expended / Interest Earned

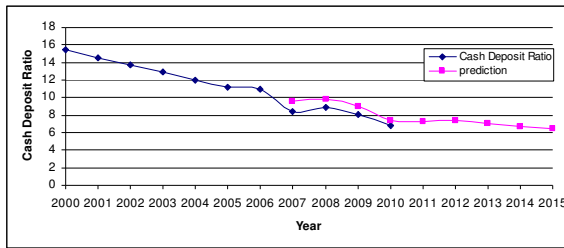


Graph 7: Selling Distribution Cost Composition

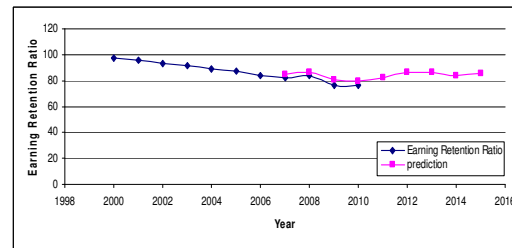
Graph 8: Financial Leverage



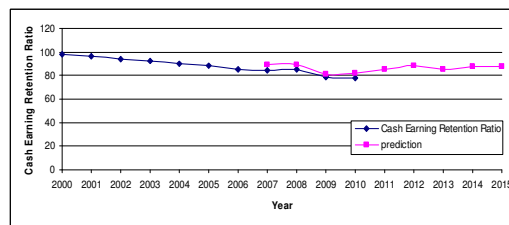
Graph 9: Interest Coverage



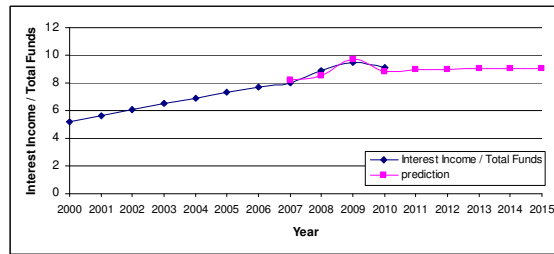
Graph 10: Credit Deposit Ratio



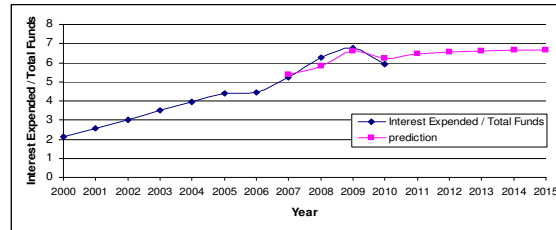
Graph 11: Cash Deposit Ratio



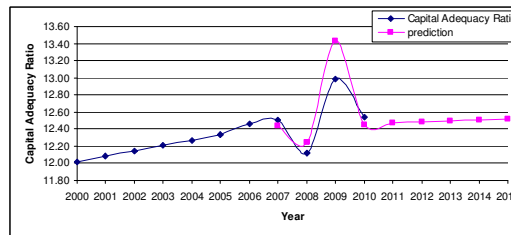
Graph 12: Earning Retention Ratio



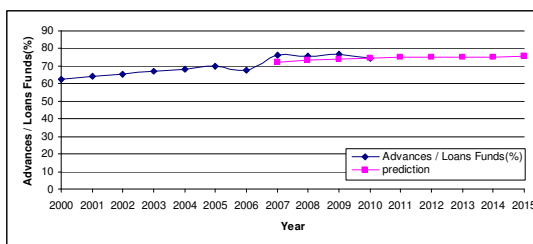
Graph 13: Cash Earning Retention Ratio



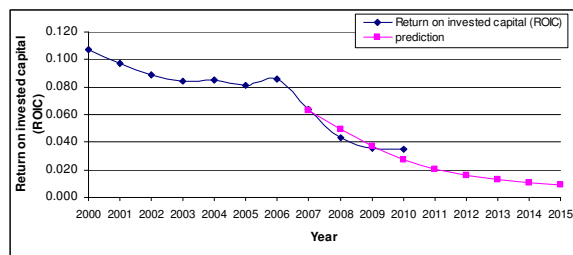
Graph 14: Interest Income / Total Funds



Graph 15: Interest Expended / Total Funds



Graph 16: Capital Adequacy Ratio



Graph 17: Advances / Loans Funds (%)

Graph 18: Return on invested capital (ROIC)

The Bank recorded 28% yoy growth in Advances and 23% yoy growth in Deposits to Rs71,566 cr and Rs1,02,695cr respectively, for FY2010. Symptomatic of higher competitive pressures for mid-sized PSU Banks, the Bank's Net Interest Income (NII) on the other hand grew a mere 8.4% on a yoy basis. The Bank's CASA ratio fell 100bp sequentially to 23% while Bulk Deposits declined 300bp to 18% of Total Deposits. Calculated NIMs remained at low levels of 4QFY2009

of around 1.8%. Other Income came in higher than expected at Rs392cr due to substantial Treasury gains of Rs237cr while core Fee Income was down 8% sequentially to Rs108cr, forex-related income was down 52% sequentially to Rs20cr and recoveries declined 7% sequentially to Rs14cr. Asset quality deteriorated sequentially, with the Gross NPA ratio increasing to 1.61% (1.53%) and Net NPA to 0.71% (0.65%) even though the Bank used the opportunity provided by large Treasury gains to make higher-than-expected provisions of Rs100cr. Gross additions to NPAs at Rs149cr (1.1% of Advances) remained lower than expected. However, the Bank's cumulative restructuring increased to a huge Rs5,500cr, translating into 7.8% of Advances and about 80% of Net Worth, which is a cause for concern, notwithstanding management's clarification that this amount was based on borrower-wise classification and not facility-wise. Capital Adequacy was comfortable at 11.8% (12.9% under Basel 2), with Tier 1 Capital Adequacy healthy at 9.1% OBC delivered 17% yoy growth in Net Profit to Rs257cr (Rs221cr, including Rs147cr Extraordinary Income from reversal of prior period tax provisions), higher than expectations on account of large Treasury gains. Currently 66% of the investment portfolio comprises of HTM (Held till maturity) and remaining 34% in AFS (Available for sale). This supports treasury gains that the bank is been able to clock for many quarters. For FY09 the bank reported Rs 481 crore of trading gains. Going ahead treasury management will be crucial owing to the fact that such high proportion is in AFS book. The bank aims total business of 2 lakh crore by FY10E. We have factored in total business of 195030 crore in FY10E, a growth of 17% over FY09. The bank targets CASA proportion to scale up to 30% for FY10E from current levels of 24% which seems highly optimistic. We see CASA proportion improving slightly to 25% for FY10E.

6. CONCLUSION

In times of economic distress the BPNN model would provide assistance to finding the financial viability of the firm. The tailored back-propagation neural network endeavors to predict the financial ratios expressing the position of a firm to regulate the bankruptcy and assess the credit viability when a bank requires credit and can also be utilized to plan the periods of recovery of the lent amount. The analysis also suggests that the model can forecast the financial position of the firm in case of loan value enhancement as well as the extension of the repayment period

implying to be effective in the designing of policy measures related to credit viability thus proves to be a vital tool to regulate the occurrence of credit defaults. As the ratio pillars incorporate all the terms to be included while assessment of the firm's financial position there are less chances of being misguided in the terms of credit lending hence the model can also act as an early warning system for the corporate and can be useful as a communication tool between the credit analyst and the management and hence serve in a practical credit risk policy context.

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